EGE AKADEMİK BAKIŞ / *EGE ACADEMIC REVIEW*

Cilt: 14 • Sayı: 3 • Temmuz 2014
ss. 441-450

Testing of APEC Countries' Competitiveness Dynamics Through Fuzzy Clustering Analysis and Some Findings

APEC Ülkeleri'nin Rekabetçi Dinamiklerinin Bulanık Kümeleme Analiziyle Test Edilmesi ve Bazı Tespitler

Kıvanç Halil ARIÇ[1] , Necati Alp ERİLLİ [2], Hatice ERKEKOĞLU[3]

ABSTRACT

Competitiveness structures of countries have an important impact on production, export and growth of countries. Porter's Diamond Model presents a comprehensive framework on the competitiveness dynamics of a country. The purpose of this study is to assert the similarities of competitiveness dynamics between APEC member countries. In this study, fuzzy clustering analysis was used. APEC countries except New Zealand, Mexico and Brunie clustered differently. It has been observed that USA, Canada, Australia, Hong Kong and Singapore are in the same cluster in 2008, 2010 and 2012; Japan, South Korea, Thailand and Taiwan are in the same cluster in 2008, 2009 and 2012. Malaysia and Chile, Russia and Vietnam, Peru and Philippines are in the same cluster in all years. So it can be said that these countries resemble with regards to competitiveness dynamics.

Keywords: APEC, competitiveness, diamond model, fuzzy clustering analysis,

ÖZET

Ülkelerin sahip oldukları rekabetçili yapıları ülkelerin üretimleri, ihracatları ve dolayısıyla büyümeleri üzerinde önemli bir yere sahiptir. Porter'ın Elmas Modeli bir ülkenin rekabetçilik dinamiklerinin neler olduğu konusunda kapsamlı bir çerçeve ortaya koymaktadır. Bu çalışmanın amacı Asya Pasifik Ekonomik İşbirliği'ne üye ülkelerin rekabetçilik dinamikleri bakımından benzerliklerinin ortaya konulmasıdır. Uygulamada bulanık kümeleme analizi kullanılmıştır. Yeni Zelanda, Meksika ve Bruney dışında kalan APEC ülkelerinin farklı şekilde kümelendiği görülmektedir. Bu çerçevede ABD, Kanada, Avustralya, Hong Kong ve Singapur 2008, 2010, 2012 yıllarında; Japonya, G. Kore, Tayland, Tayvan 2008, 2009, 2012 yıllarında; Malezya ile Şili'nin ve Rusya ile Vietnam'ın Peru ile Filipinler'in ise tüm yıllarda aynı kümede yer aldığı dolayısıyla rekabetçi dinamikleri bakımından birbirine yakın olduğu söylenebilir.

Anahtar Kelimeler: APEC, rekabetçilik, elmas modeli, bulanık kümeleme analizi

1.INTRODUCTION

World Economic Forum defines competitiveness as followings; competitiveness is the set of institutions, policies and factors that determine the level of productivity of a country (WEF, 2012: 4). As the meaning of this definition is examined it can be realized that there are many factors determining competitiveness. The concept of competitiveness contains different levels such as product, firm, industry, region, country, commercial integration and global level. Additionally, it can be said that there is an important correlation between these levels. Because an in stock products or services have an impact on the competitiveness of the firm. And economical performance of the firm has an impact on its own sector, region and global competitiveness level of its own country (Anca, 2012: 41).

Technology is one of the most important factors affecting the increase in productivity. Because of the mobility of technology, developed countries lose their technological advantages. When compared to developed countries, recently industrialized Asian countries benefit from technology better and increase their productivity (Krugman, 1994: 76-77).

Infrastructure and economic integration are other important factors. Thanks to the development of national infrastructures and integration to world economy, East Asian countries industrialized rapidly by the end of 20th century. Countries in this region enhanced transportation infrastructures, set up export promo-

[1] **Assist. Prof., Cumhuriyet University, Faculty of Economics and Administrative Sciences, Department of International Trade and Logistic, kharic@cumhuriyet.edu.tr**
[2] **Assist. Prof., Cumhuriyet University, Faculty of Economics and Administrative Sciences, Department of Econometrics, aerilli@cumhuriyet.edu.tr**
[3] **Assoc. Prof., Erciyes Üniversitesi, School of Applied Sciences, Department of International Trade and Logistic, haticeer@erciyes.edu.tr**

tion areas and constructed industrial centers for global investments (Gutty, et all., 2009: 437). Many of the East Asian countries' governments focus on regional/spatial dimensions of industrial activities. Grouping of firms in the region, establishment of intra sector connections and strengthening of domestic network structures are the main implementations carried out by the governments in order to improve global competitiveness of sectors (Gutty, et all., 2009: 437).

Maintenance of the high-level competitiveness is very significant for developing countries in terms of their exports and growths. For this reason, the question what the determinants of competitiveness is became an important issue (Naceur et all., 2012: 223).

According to classical economists, competitiveness is determined by quantitative factors such as labour, land, capital and natural resources. However, in today's world where the globalization increased relations between countries classical theory remains incapable in terms of the determinants of competitiveness. Qualitative factors such as political stability, quality of education, environmental conditions, institutional factors and social norms have also impact as the determinants of competitiveness (Stevans, 2012: 76).

At the present time, the production costs of firms are affected less by the using production factors. When considered from this point of view, decreases in labour costs are insufficient in terms of the maintenance of competitiveness. Research and development activities, infrastructure expenditures and industrial organisations come into prominence on the subject of competitiveness in the world markets (Erber et all., 1997: 341).

In today's world where factors determining competitiveness contain different factors than the factors of classical theory, it can be said that Porter's Competitive Advantage Theory and Diamond Model shaping on the basis of this theory contain the factors which can be used in determination of competitiveness of firms, sectors and countries. The purpose of this study is to reveal the similarities between dynamics determining the competitiveness of APEC countries. Fuzzy clustering analysis was used as the method. The purpose of APEC is to support the sustainable economic growth and welfare in Asia-Pacific region. In this context, there are some targets such as liberalization of member countries' trade, realization of regional economic integration, promotion of economic and technological cooperation and enhancement of workplace environment (APEC, www.apec.org).

It can be said that the economic integrations of Asian-Pacific countries are shaped market-oriented. The political system, cultural structure and development level differences between these countries may be a determinant of difficulties in providing economic integration. However high-level growth rates of these countries for the last 20 years are important in terms of their economic integrations (Lee, 2012: 55).

2.THEORETICAL FRAMEWORK

By Porter, domestic characteristics are prominent in terms of increase in productivity and maintenance of competition. The differences of economic structures, culture, institutional structures and historical backgrounds between countries have impact on the competitiveness of countries (Porter, 1998: 19).

According to Porter's Diamond Model, there four interrelated factors determining competitive advantage of a certain region. These are 1) factor conditions, 2) demand conditions, 3) related and supporting industries and 4) firm strategy, structure and rivalry. And chance and government factors affect these four factors. However these two factors do not have determinative features on their own (Neven ve Cornelia, 2001: 4).

Factors in the model in Figure 1 are interrelated except chance and government. In order to occur the impact of one of the dynamics, other dynamic conditions should also occur. For instance, demand conditions dynamic is not effective on access to competitive advantage when the firms are not adequately competitive to respond this demand (Porter, 1998: 72).

Diamond Model is a model which is used to explain competitive advantage in firm, industry and country level. This model did not determine a certain methodology for researchers in terms of the method researchers will use. So, in the implementation of the model there may occur some differences. Additionally, the untestability of the results obtaining through this model is criticised. Using more qualitative variable than quantitative variables may be considered as a weakness in terms of the evaluation of the model. The values of variables in 'Global Competitiveness Report' published by World Economic Forum annually may be considered as important quantitative data resource that can strength this weakness of competitive advantage analysis. Michael Porter contributed to the preparation process of this report and this report contains some variables related to four main factors of Diamond Model (Arıç, 2013: 95).

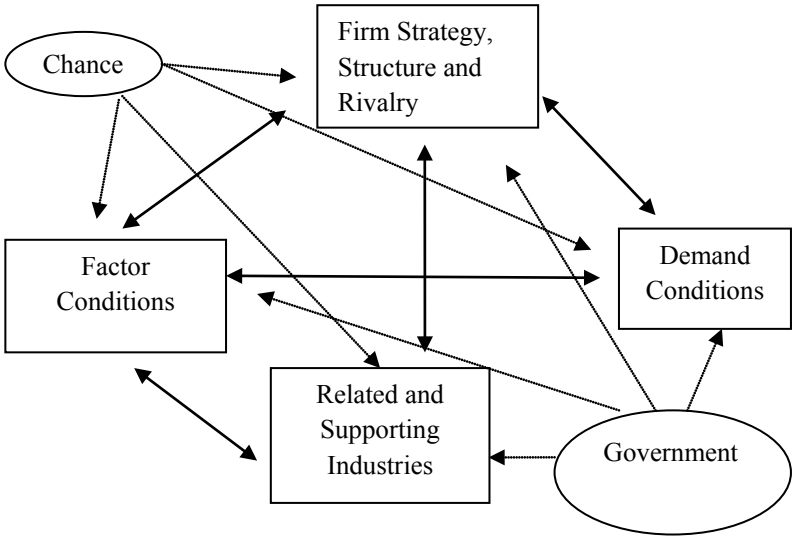

Figure 1: Determinants of National Competitiveness. Diamond Model (Porter, 1998: 72)

3.LITERATURE REVIEW

Tamamura (2002) did a research about the competitiveness of Asian countries in the framework of change in their industrial structures. In this research input-output analysis was used. Especially, he focused on changes in the demand for manufacturing industry. And in this research, export competitiveness of countries was evaluated by using RCA (revealed comparative advantage) and TSC (Trade Specialization Coefficient) indexes (Tamamura, 2002: 52).

In a study of Leow ve Normee (2009) there is an econometric application on Malaysia's manufactured good export competitiveness. According to result of this application, free trade provides Malaysia manufactured good export competitiveness in East Asia region. Foreign investors do not have an important effect on Malaysia's export. Interest rates have a partial effect on private investments (Leow ve Normee, 2009).

Li et all (2009) examined the competitiveness of Hong Kong in the period of 1980-2005. According to econometric analysis on total factor productivity of Hong Kong, thanks to Closer Economic Partnership Agreement (CEPA) between Hong Kong and China, the increase in total factor productivity rate became the best performance in East Asia. In sectoral level, competitiveness of Hong Kong falls behind in terms of exports of many important goods and services. So, the innovations in service sector should be supported in order to maintain the increase in total factor productivity (Li et all., 2009: 573, 574, 580).

Huang et all. (2009) did a research on tourism sector competitiveness of Asian countries. Fuzzy Rasch model was used as analysis method. They present tourism competitiveness ratings of 9 Asian countries for the year of 2009 (Huand et all., 2009: 456).

In another research done by Langdale (1997), competitiveness of Asian countries are examined in terms of telecommunication and multimedia technologies. He benefited from literature data in his research. Related technologies have an important impact on international competitiveness of developed Asian countries. In addition to competitiveness between countries, a cooperation agreement between firms is an important factor in this field. Other East Asian countries also locate their investments in this field (Langdale, 1997: 235).

Manzur et all. (1999) calculated real exchange rates as a determinant of international competitiveness by using a new method. In this new method currencies are weighted instead of using one country's currency and this method was implemented for 5 East Asian countries. Additionally, in order to make comparison real exchange rates of these countries were calculated on the basis of purchasing power parity (PPP). In this analysis cointegration test was implemented. According to the test results, there is a correlation between the growth of export and real exchange rate calculated by new method. However, a correlation between the growth of export and real exchange rate calculated by PPP was not found (Manzur et all., 1999: 1383).

Kao et all. (2008) presented a method related to measurement of national competitiveness. In this study they examined 10 Southeast Asia countries. Data obtained through survey are used within the

context of index. According to results Singapore, Malaysia and Thailand are countries having highest competitiveness. And the least competitive countries are Myanmar, Cambodia and Laos (Kao et all., 2008: 613).

In Brumer and Cali's study, manufactured good export competitiveness of Southasian countries in the period of 1991-2002 was compared with OECD countries. Unit value analysis was used and this analysis shows export competitiveness and reflects price-quantity ratio. 'Real competitiveness' analysis was carried out in terms of relative competitiveness positions of countries. Increase in exports of Southasian countries arise from production growth which originates from relative low costs. It does not arise from good quality increase (Brunner and Cali, 2006: 557).

Goto states that global value chain is resources for developing countries in terms of employment of these countries and this factor is important in terms of competitiveness of these countries. In his study, he examined the interaction between economic growth and convenient working conditions with global competition chain within the context of ready-made clothing sector of 5 Asian countries. According to results, domestic market conditions and labor market conditions have impact on competitiveness of a country in terms of shaping the working conditions (Goto, 2011: 943).

Naceur et all. state in their study that international capital and flow of foreign currency are important for developing countries. However these flows cause appreciation of real exchange rate in the country and this situation affects growth and export negatively so competitiveness of the country may decrease. In the study they analyzed six types of capital flows that may have impact on real exchange rates in terms of 57 developing countries containing Africa, Europe, Asia, Latin America and Middle East by using panel data method. According to results, portfolio investments, foreign borrowing, financial supports and income appreciate real exchange rate. The effects of money transfers differ from regions to regions. And direct foreign investments do not have impact on real exchange rates (Naceur et all., 2012: 223).

4.DATA SET AND METHOD

The study contains 20 APEC members' countries. 15 data was used related to each country. These data were obtained through World Economic Forum reports and include the period of 2008-2012. These are data indicated in Porter's Diamond Model and determine competitiveness dynamics of countries. Quality of all infrastructures, financial market sophistication, direct foreign investment and technology transfer, quality of scientific institutions, saving rate data were used relating to factor conditions in Diamond Model. Degree of customer orientation, buyer sophistication and domestic market size data were used relating to demand conditions. Local supplier quality, state of cluster development, value chain breadth data were used relating to related and supporting industry conditions. Intensity of local competition, capacity of local competition, cooperation in labour employer, production process sophistication data were used relating to firm strategy, structure and rivalry conditions.

4.1.Fuzzy Clustering Analysis

Clustering analysis is a method that provides classification of examined units according to their similarities by bringing them in certain groups and exhibition of their common features and making common definitions about these groups. The purpose is to classify ungrouped data according to their similarities and to obtain convenient summary data appropriate for research (Hardle and Simar, 2003: 302). In other words, it provides the collection of similar data in the same group or cluster by focusing on the similarities between data. It appears as a convenient method when clusters do not diverge from each other prominently or some units are indecisive about cluster membership. Fuzzy clusters are functions that determine each unit between 0 and 1 which is defined as the membership of unit in the cluster. Very similar units are placed in the same cluster according to high membership degree (Erilli, 2009: 31).

Fuzzy clustering method is more advantageous than classical clustering methods in terms of giving more detailed information. On the other hand, it has also disadvantages. When there is a large number individual and clusters, there will be many outputs so that summarizing and classification of data will be hard. Additionally fuzzy clustering algorithms are generally complicated and they are used when there is more uncertainty (Bezdek, 1974).

In this study, analyses are performed with Fuzzy C-Means method which is frequently used method in Fuzzy Clustering Analysis theory.

4.2.Fuzzy C-Means Algorithm (FCM)

Fuzzy C-Means algorithm generates the basis of all clustering techniques based on objective function. It was developed by Bezdek (1974). When Fuzzy C-Means Algorithm is concluded, points in the p-dimensional space become spherical. It is assumed that these clusters are approximately in the same dimension. Each cluster is symbolized by its cluster center and these are called as prototype. Euclidean distance between data and cluster center is used as a distance

measure is given in equation 1. (Bezdek, 1974)

$$d_{ik} = d\left(x_i, v_k\right) = \left[\sum_{t=1}^{p}\left(x_{ji} - v_{jk}\right)^2\right]^{1/2} \quad (1)$$

In this formula, symbolizes the position of observation value in coordinate system and symbolises cluster center. In order to implement this technique, the number of cluster and cluster membership degrees of individuals must be known beforehand. These values can be found through trial-and-error method or some other developed techniques because it is hard to know these types of parameters beforehand. The objective function used for this clustering method is as following; (Bezdek, 1974)

$$J\left(u,v\right) = \sum_{j=1}^{n}\sum_{k=1}^{c} u_{jk}^{m}\left\|x_{ji} - v_{jk}\right\|^2 \quad (2)$$

The function given in equation 2, is called weighted least square function. Here, parameter "*n*" symbolizes the number of observations and, "*c*" symbolizes the number of clusters. u_{jk}^{m} symbolizes the membership of in x_j k[th] cluster. $J(u,v)$ is a measure of sum of all weighted error squares (Sintas et all., 1999).

If function is minimized for all values of *c*, in other words if the first degree derivate of this function is taken by and equals to 0, the prototype of FCM algorithm will be as followings (Sintas et all., 1999);

$$v_{jk} = \frac{\sum_{i=1}^{n} u_{jk}^{m} \cdot x_{ik}}{\sum_{i=1}^{n} u_{jk}^{m}} \quad (3)$$

The number of cluster *c*, fuzziness index *m*, process ending criteria ε and membership degrees matrix *U* or *V* of FCM algorithm generate cluster prototypes at random. By taking means of these values, membership degrees matrix is calculated as in equation 4. (Sintas et all., 1999).

$$u_{ik} = \left[\sum_{j=1}^{c}\left(\frac{d_{ji}}{d_{jk}}\right)^{2/m-1}\right]^{-1} \quad (4)$$

U cluster prototypes are updated in all iteration and the processes are repeated until $\left\|U^{(t)} - U^{(t-1)}\right\|$ value reach to previously determined error term. After FCM algorithms is implemented membership degrees are used in other to decide which individual will participate in which cluster. For each individual; the highest cluster membership is observed and this individual is added to that cluster. However each individual can participate in other clusters with a certain membership degree (Sintas et all., 1999).

4.3.Fuzzy Clustering Validity Index

Clustering analysis aims similar objects into same groups. In many of the clustering algorithm, the number of cluster must be known beforehand. In studies based on real data, if the researchers do not have preliminary information about the number of cluster, it cannot be known whether the number of cluster which calculated is more or less than the real number of cluster. Determination processes of the optimal number of clusters are generally called as Cluster Validity. So, after clustering processes are carried out the validity of the number of cluster which calculated can be determined (Erilli, 2009: 47).

Many fuzzy clustering analysis validity indexes are used in literature (Bezdek, 1974 and 1981; Rezaee et all., 1998; Kwon, 1998; Xie and Beni, 1991). Convenient clustering validity analyses are used depending on data structure and the number of variables. In this study, Artificial Neural Networks Based Cluster Validity Index was used.

4.4. Artificial Neural Networks Based Cluster Validity Index

This method was proposed by Erilli et all. (2011). In this method at first the lowest and the highest number of cluster which are convenient to data are decided. The most convenient determined number of cluster will be in this interval. Lets the optimal number of cluster is c_{opt}, maximum number of the cluster is $c_{\max}$ and minimum number of the cluster is $c_{\min}$, are defined. The relation between them will be like that; $c_{\min} \le c_{opt} \le c_{\max}$. Then, feed-forward artificial neural networks are implemented for each possible numbers of clusters in the manner that its output will be data matrix and its target value will be the number of cluster to which each data is appointed as a result of fuzzy clustering. The median of RMSE (root-mean-square error) value which is obtained through artificial neural networks according to several hidden layer unit number are calculated for each number of clusters. The graph or obtained median values of each number of clusters or classification error is drawn and the first jumping (where median value of

RMSE overgrows for the first time) is observed. Then pre-jumping value is determined as the most convenient number of cluster (Erilli et all., 2011).

5.IMPLEMENTATION

In the implementation 20 APEC countries are classified through fuzzy clustering analysis by using 15 variables belonging to the period of 2008-2012. The numbers of clusters in fuzzy clustering analysis are found by means of Artificial Neural Networks Based Cluster Validity Index calculation. For each year the numbers of clusters are calculated from 2 to 10. The graphs of determined cluster numbers are given Figure 2. In Figure 2, it is seen that the first important jumping is determined as cluster number. Accordingly, convenient cluster numbers are determined as 4 in 2008, 2010 and 2012; as 5 in 2009 and 2011. So it can be said that cluster numbers are 4 for even-numbered years and 5 for odd-numbered years.

After convenient cluster numbers are determined, clusters of countries are determined by calculating with Fuzzy C-Means Method for each year. Results of clustering analysis for each year are given in Table 1, Table 2, Table 3, Table 4 and Table 5.

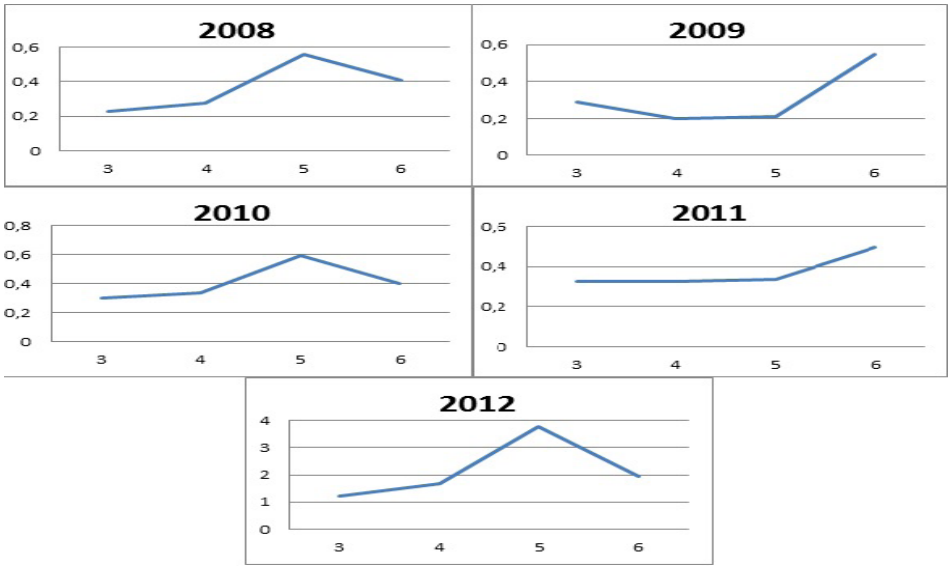

Figure 2: Graphs of Cluster Numbers with Respect to Years

When seeing cluster memberships relating these 5 years, it can be seen that countries are in different clusters in terms of the similarities of competitiveness dynamics. When seeing three-year similarities, some detection may occur about countries. USA, Canada, Australia, Hong Kong and Singapore are in the same cluster. Japan, S. Korea, Thailand and Taiwan are in the other same cluster. China and Indonesia are generally in the other same cluster. On the other hand, Malaysia and Chile are continually in the same cluster by showing similarity in terms of competitiveness dynamics in this five-year period. In the same way, Russia and Vietnam are in the same cluster. Peru and Philippines are also in the same cluster in this five year. There is not stability of cluster memberships of New Zealand, Mexico and Brunei. They are in different clusters in different years.

Table 1: Fuzzy Clustering Analysis Results by Data of 2008

1	2	3	4
Singapore	Mexico	S. Korea	Philippines
USA	New Zealand	Thailand	Russia
Australia		Japan	Vietnam
Canada		Malaysia	Indonesia
Hong Kong		Taiwan	Peru
		Chile	China
		Brunei	

Table 2: Fuzzy Clustering Analysis Results by Data of 2009

1	2	3	4	5
Singapore	Vietnam	Peru	New Zealand	S. Korea
USA	Russia	China	Malaysia	Thailand
Canada		Philippines	Australia	Japan
Hong Kong			Chile	Indonesia
				Mexico
				Brunei
				Taiwan

Table 3: Fuzzy Clustering Analysis Results by Data of 2010

1	2	3	4
Singapore	China	S. Korea	Philippines
USA	Russia	Thailand	Indonesia
Malaysia	Vietnam	Japan	Peru
Chile	Mexico	New Zealand	
Australia		Brunei	
Canada			
Hong Kong			
Taiwan			

Table 4: Fuzzy Clustering Analysis Results by Data of 2011

1	2	3	4	5
Singapore	Vietnam	Thailand	Japan	S. Korea
Canada	Russia	Indonesia	Malaysia	Brunei
Hong Kong		Philippines	USA	
		Mexico	New Zealand	
		Peru	Australia	
		China	Chile	
			Taiwan	

Table 5: Fuzzy Clustering Analysis Results by Data of 2012

1	2	3	4
Singapore	China	S. Korea	Russia
USA	Peru	Thailand	Vietnam
Malaysia	Indonesia	Japan	
Australia	Mexico	Taiwan	
New Zealand	Brunei		
Canada	Philippines		
Hong Kong			
Chile			

Porter states that the factors in Diamond Model determine competitiveness dynamics of a country and these dynamics may affect country's export potential by way of competitiveness structure (Porter, 1998). Accordingly, it can be said that the export potential of countries whose competitiveness conditions are well affected by this situation positively. And it can be thought that countries which have developed competitiveness dynamics have high production capacities. GDP can be considered as an indicator of production amount in an economy.

Table 6: Average GDP and Export Increase Rates of Analyzed Countries in the Five-Year Period

Country	Average GDP increase (%)	Average export increase (%)	Country	Average GDP increase (%)	Average export increase (%)	Country	Average GDP increase (%)	Average export increase (%)
Singapore	4,4	4,8	USA	0,5	3,6	Australia	2,6	2,6
Canada	1	1,8	H. Kong	2,5	3,2	S. Korea	2,2	7,4
Thailand	2,8	4,1	Japan	-0,1	0,3	Taiwan	4,1	NA
Indonesia	5,9	7,1	China	9,2	8,6	Malaysia	4,2	1,55
Chile	3,9	1,13	Vietnam	5,8	10	Russia	1,9	0,8
Peru	6,5	3,7	Philippines	4,6	1,5	Mexico	1,6	3,8
New Zealand	0,6	1,4	Brunei	0,6	-0,6			

(**Note:** Since 2012-year data of some countries cannot be obtained, four-year data in the period of 2008-2011 was used for average export increase rate.)
(**Source:** http://data.worldbank.org/indicator; http://www.gfmag.com/gdp-data-country-reports/166-taiwan-gdp-country-report.html#axzz2Zm1uDllh)

When it is expected that competitiveness dynamics have impact on export and GDP of a country, it can be said that countries having similar competition structure have similar export and GDP increase rates. In this respect, APEC countries will be compared below in terms of GDP and export values. Their accordance with cluster memberships will be mentioned. When GDP and annual export increase rates of countries which are in similar clusters in terms of competitiveness dynamics are compared, Indonesia and China which are in the same cluster in terms of competitiveness dynamics have similar GDP and export increase rates. Additionally, Malaysia and Chile which have similar competitiveness dynamics have similar GDP and export increase rates. However, although Russia and Vietnam are in the same cluster in terms of competitiveness dynamics for 5 years they are very different from each other in terms of their GDP and export increase rates. It can be said that other countries being in the same cluster in terms of competitiveness dynamics have different GDP and export increase rates.

6.RESULT

Competitiveness of APEC member countries were analyzed through fuzzy clustering analysis method within the context of Diamond Model. In this way, it was aimed to reach to countries which have similar competitiveness dynamics structure. By using 15 Diamond Model data relating 20 APEC member countries, the clusters which contain the countries having similar competitiveness dynamics in certain years are shown.

USA, Canada, Australia, Hong Kong and Singapore are in the same cluster in 2008, 2010, 2012. Japan, South Korea, Thailand and Taiwan are in the same cluster in 2008, 2009 and 2012. China and Indonesia are in the same cluster in 2008, 2011 and 2012. It can be said that competitiveness dynamics of these countries are similar for these years. Clusters they are found in other years are different. It can be asserted that 2008 Global Crisis has impact on competitiveness structures of countries and countries having similar competitiveness dynamics become different in the next three years (2009-2011). Clusters in 2012 are parallel with the pre-crisis clusters and countries having similar competitiveness dynamics come up to each other.

When examining the countries having similar competitiveness structures for 5 years it is seen that Malaysia & Chile, and Russia & Vietnam are in the same cluster in all years. It can be said that these countries show similar competitiveness structures. And since Peru and Philippines are in the same cluster it can be asserted that these countries have similar competitiveness structures.

The impact of competitiveness structures of countries on GDP and export bring about these situations. Indonesia and China which are in the same cluster in terms of competitiveness dynamics also show similarities in terms of GDP and export increase rates. Additionally, Malaysia and Chile which are in the same cluster in terms of competitiveness dynamics also show similarities in terms of GDP and export increase rates. Although Russia and Vietnam are in the same cluster in terms of competitiveness dynamics for 5 years they are very different from each other in terms of their GDP and export increase rates. It can be said that other countries being in the same cluster in terms of competitiveness dynamics have different GDP and export increase rates. There is not stability of cluster memberships of New Zealand, Mexico and Brunei. They are in different clusters in different years.

REFERENCES

Anca, H.D.B. (2012) "Literature Review of the Evolution of Competitiveness Concept" *Annals of the University of Oradea: Economic Science*, 1(1):41-46.

APEC, Mission Statement, http://www.apec.org/About-Us/About-APEC/Mission-Statement.aspx (25.07.2013)

Arıç, K.H. (2013) "The Structure of Porter's Competitive Advantage Theory as a New Foreign Theory" *KAU IIBF Dergisi*, 4(5):81-97.

Bezdek, J.C. (1981) *Pattern Recognition With Fuzzy Objective Function Algorithms*, NY Plenum Press.

Bezdek, J.C. (1974) "Cluster Validity With Fuzzy Sets*" J. Cybernetics*, 3:58-73.

Brunner, H.P. ve Cali, M. (2006) "The Dynamics of Manufacturing Competitiveness in South Asia: an Analysis Through Export Data" *Journal of Asian Economics*, 17:557-582.

Erber, G., Hagemann, H. ve Seiter, S. (1997) "Global Competitiveness: Industrial Policy in the Performance of Asia and Europe" *Journal of Contemporary Asia*, 27(3):338-355.

Erilli, N.A., Yolcu, U., Eğrioğlu, E., Aladağ, Ç.H. ve Öner, Y. (2011) "Determining the Most Proper Number of Cluster in Fuzzy Clustering by Artificial Neural Networks" *Expert Systems with Applications*, 38:2248-2252.

Erilli, N.A. (2009) "Kümeleme Analizine Bulanık Yaklaşım Algoritmaları ve Uygulamaları" Yayınlanmamış Yüksek Lisans Tezi, Samsun, 19 Mayıs Üniversitesi Fen Bilimleri Enstitüsü.

Global Finance, http://www.gfmag.com/gdp-data-country-reports/166-taiwan-gdp-country-report.html#axzz2Zm1uDlIh, (27.06.2013).

Goto, K. (2011) "Competitiveness and Decent Work in Global Value Chains: Substitutionary or Complementary?" *Development in Practice*, 21(7):943-958.

Hardle, W. ve Simar, L. (2003) *Applied Multivariate Statistical Analysis*, Springer-Werlag Pub, Berlin, Germany.

Huang, J.H. ve Peng, K.H. (2012) "Fuzzy Rasch Model in TOPSIS: a New Approach for Generating Fuzzy Numbers to Assess the Competitiveness of the Toursim Industries in Asian Countries" *Tourism Management*, 33:456-465.

Kao, C., Wu, W.Y., Hsieh, W.J., Wang, T.Y., Lin, C. ve Chen, L.H. (2008) "Measuring the National Competitiveness of Southeast Asian Countries" *Eurpoean Journal of Operational Research*, 187:613-628.

Krugman, P. (1994) "The Myth of Asia's Miracle" *Foreign Affairs*, 73(6):62-78

Kwon, S.H. (1998) "Cluster Validity Index For Fuzzy Clustering" *Elec. Lett,* 34(22):2176-2178.

Langdale, J.V. (1997) "International Competitiveness in East Asia: Broadband Telecommunications and Interactive Multimedia" *Telecommunications Policy*, 21(3):235-249.

Lee, J.S. (2012) "A Study on APEC's Economic Cooperations Under WTO" *International Journal Business Administration,* 3(6):55-59.

Leow, G.Y. ve Normee, C.S. (2009) "Benchmarking Malaysia's Manufactured Exports Competitiveness" *Malaysian Journal of Economic Studies*, 46(2):175-200.

Li, H., Wei, X. ve Xie, D. (2009) "Competitiveness of the Hong Kong Economy" *China Economic Review*, 20:573-586.

Manzur, M., Wong, W.K. ve Chee, I.C. (1999) "Measuring International Competitiveness: Experience from East Asia" *Applied Economics*, 31:1383-1391.

Naceur, S.B., Bakardzhieva, D. ve Kamar, B. (2012) "Disaggregated Capital Flows and Developing Countries' Competitiveness" *World Development*, 40(2):223-237.

Neven, D. ve Droge, C.L.M. (2001) "A Diamond fort he Poor? Assessing Porter's Diamond Model fort he Analysis of Agro-Food Clusters in the Developing Countries", http://www.agrifood.info/Agrifood/members/Congress/Congress2001Papers/Symposium/Neven.pdf,

Porter, E.M. (1998) *The Competitive Advantages of Nations*, New Edition, Palgrave.

Rezaee, M.R., Lelieveldt, B.P.F. ve Reiber, J.H.C. (1998) "A New Cluster Validity Index for the FCM" *Pattern Recognition Lett*., 19:237-246.

Sintas, A.F., Cadenas, J.M. ve Martin, F. (1999) "Membership Functions in the Fuzzy c-Means Algorithm" *Fuzzy Sets and Systems*, 101.

Stevans, L.K., Neelankavil, J.P., Mendoza, R. ve Shankar, S. (2012) "The Economic Competitiveness of Countries: a Principal Factors Approach" *International Journal of Economics and Finance*, 4(12):76-90.

Tamamura, C. (2002) "Structural Changes in International Industrial Linkages and Export Competitiveness in the Asia-Pacific Region" *ASEAN Economic Bulletin*, 19(1):52-82.

World Bank (2013) http://data.worldbank.org/indicator, (20.04.2013)

World Economic Forum (2008) The Global Competitiveness Report 2008-2009, Geneva, Switzerland.

World Economic Forum (2009) The Global Competitiveness Report 2009-2010, Geneva, Switzerland.

World Economic Forum (2010) The Global Competitiveness Report 2010-2011, Geneva, Switzerland.

World Economic Forum (2011) The Global Competitiveness Report *2011-2012*, Geneva, Switzerland.

World Economic Forum (2012) *The Global Competitiveness Report 2012-2013*, Geneva, Switzerland.

Xie, L. ve Beni, G. (1991) "A Validity Measure for Fuzzy Clustering" *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 13(4):841-846